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Awareness and Vaccination Adherence of Hepatitis B among Medical Students in the Western Region of Saudi Arabia: A Cross-Sectional Study

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Abstract **Objectives:** Hepatitis B Virus (HBV) is a major public health concern, particularly among medical students who are at high risk due to clinical training, exposure to blood and the absence of mandatory screening programs, vaccination helps to reduce morbidity and mortality. This study aimed to elucidate HBV awareness and vaccination adherence among medical students in Western Saudi Arabia. **Methods:** From October 2023 to January 2024, a cross-sectional survey was. carried out in the Western Region of Saudi Arabia. An online self-administered questionnaire was used to collect data from a randomized sample of 376 undergraduate medical students across six governmental universities. **Results:** HBV vaccination adherence among medical students showed a significant association with their university ($p<0.001$). More than half were immunized, either through hepatitis B vaccination (43.6%) or due to a previous infection (10.9%). The most common reasons for non-vaccination were busy schedules 96 (25.5%) and forgetting to get vaccinated 86 (22.9%). Additionally, 60 (16%) of students expressed concerns about side effects or believed the vaccine was ineffective 52 (13.8%). Furthermore, 90 (28.8%) of students were unaware of or unable to access vaccination sites and 14 (3.7%) cited other reasons. **Conclusion:** More than half of the medical students had either been vaccinated against HBV or had acquired immunity from prior infections. However, knowledge of HBV was moderate, about 61% recognize that HBV is more contagious than HIV, while poor vaccination adherence persisted due to misunderstandings and gaps in knowledge. To improve vaccination adherence, evidence-based educational programs should be implemented, followed by effective immunization strategies and pre-clinical vaccine screening.

Key Words Hepatitis B Infection, Hepatitis B Vaccination, Cross-Sectional Study, Medical Students, Saudi Arabia

INTRODUCTION

Hepatitis B Virus (HBV) infection is a clinically significant, widely prevalent viral disease [1]. It Affects liver function, causing both acute and chronic hepatic disease, which can lead to serious conditions such as cirrhosis or hepatocellular carcinoma [2] HBV can be transmitted through exposure to blood or body fluid infected with the virus [3]. Transmission occurs via needle stick injuries, vertical transmission, tattooing, piercing and sexual contact. The World Health Organization (WHO) estimated that in 2022, approximately 254 million individuals were living with chronic hepatitis, resulting in about 1.1 million deaths [4].

Viral hepatitis, particularly HBV, is considered a major public health issue in Saudi Arabia. Hepatitis B is the most common form of viral hepatitis in the Kingdom of Saudi Arabia (KSA). According to the Ministry of Health in KSA, there were an estimated 4,955 cases of HBV in 2021 [5,6]. The HBV vaccine has been available since 1982 and in KSA, a vaccination programme was initiated in 1989 for children at 2, 4 and 6 months of age. A 1-year catch-up programme was also introduced, targeting children entering school and individuals at high risk, such as healthcare workers [7,8]. Adherence to the hepatitis B vaccine can significantly reduce the risk of HBV transmission [9]. Medical students are considered part of the healthcare workforce and are at high risk of contracting HBV due to occupational exposure to infected blood or bodily fluids during clinical training [10]. Consequently, medical students' knowledge of and adherence to the hepatitis B vaccine play a crucial role in reducing the risk of HBV infection. Several studies have evaluated medical students' awareness and

adherence to hepatitis B vaccination. Internationally, a cross-sectional survey in Somalia found that 73.7% of participants had adequate knowledge of hepatitis B, but only 2.8% were fully immunised. Key reasons for low vaccination rates included the unavailability of the vaccine (32.8%) and its high cost (26.7%) [2]. A study in Nepal involving pre-clinical medical students revealed that 74.6% had not been vaccinated against hepatitis B, largely because of a lack of vaccination programmes. Moreover, 50.8% of participants demonstrated positive attitudes, practices and knowledge about hepatitis B [11].

In Saudi Arabia, a study conducted at governmental universities in Riyadh revealed poor adherence to the hepatitis B vaccine, with limited knowledge of HBV, its transmission and immunisation [1]. A cross-sectional study at King Khalid University Hospital showed that 53.5% of the 444 participants had moderate to poor knowledge of the disease and only 59.5% had received all three doses of the hepatitis B vaccine [3]. Another study conducted in Al-Qassim University found that 41.4% of 321 students were vaccinated against HBV, while only 21% had adequate knowledge of HBV infection prevention [12].

Although some local studies have explored medical students' knowledge of HBV infection and vaccination adherence, none have included students from the Western Region of Saudi Arabia. This study aimed to elucidate the awareness and vaccination adherence to hepatitis B among medical students in the Western Region of Saudi Arabia.

Literature Review

There is several study that investigant the awareness and adherance of HBV vaccination among medical student, several studies have evaluated medical students' awareness and adherence to hepatitis B vaccination. Internationally, a cross-sectional survey in Somalia found that 73.7% of participants had adequate knowledge of hepatitis B, but only 2.8% were fully immunised. Key reasons for low vaccination rates included the unavailability of the vaccine (32.8%) and its high cost (26.7%) [2]. A study in Nepal involving pre-clinical medical students revealed that 74.6% had not been vaccinated against hepatitis B, largely because of a lack of vaccination programmes. Moreover, 50.8% of participants demonstrated positive attitudes, practices and knowledge about hepatitis B [11].

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Objectives:

- **Primary Objective:** To assess the level of knowledge and vaccine adherence of hepatitis B among medical students in the western region of Saudi Arabia
- **Secondary Objectives:** To determine the immunization status against hepatitis B among medical students in the western region of Saudi Arabia
- To determine the factors influencing hepatitis B vaccine adherence among medical students in the western region of Saudi Arabia
- To explore the association between hepatitis B level of knowledge and vaccine adherence with different socio-demographic characteristics

METHODS

Study Design

A cross-sectional study was conducted from October 2023 to December 2023 among medical students in the western region of Saudi Arabia. The inclusion criteria encompassed all undergraduate medical students at six governmental universities in the western region of Saudi Arabia: Umm Al-Qura University, Taif University, King Saud bin Abdulaziz University for Health Sciences in Jeddah, Jeddah University, King Abdulaziz University and Taibah University. Students not from the Western region and those who refused to participate were excluded. A convenience sampling method was used, as participation was voluntary and based on self-selection through an online. This study is adhere to STROBE guideline for cross sectional study. A compleat STROBE checklist is provided as supplementary file 1.

Study Procedure

The sample size was calculated using OpenEpi version 3.0, resulting in a target of 362 participants based on a 95% confidence interval and a 5% margin of error.

Data Collection

The data were collected by a self-administered online Google form. The questionnaire was modified from a previously published study [1]. The questionnaire included three sections. The first section asks about demographic data, consisting of gender, age, nationality, university, academic year and GPA. The second section included four questions to assess participants' Hepatitis B virus status and vaccination adherence. The last section had four questions to measure students' general knowledge about the Hepatitis B virus. The questionnaire was distributed via social media platforms such as Telegram, WhatsApp, Twitter and Snapchat. No follow-up reminders were sent after the initial distribution. The participants' responses were collected through a combination of true/false items on a linear scale, multiple-choice questions and checkboxes. All participants who accessed the questionnaire completed it and no responses were excluded. There were no missing data, as all mandatory fields were required to be completed before the questionnaire could be submitted.

Statistical Analysis

Cronbach's alpha was used to assess the internal consistency reliability of the questionnaire for both the initial and retest administrations. A pilot study involving 20 participants, who were not included in the main study, was conducted to evaluate face validity and internal consistency. The results indicated that the median Cronbach's alpha values for both the original and retest administrations were >0.82. Additionally, test–retest reliability was evaluated over a 2-week interval, with Pearson product-moment correlations between the first and second administrations revealing correlation coefficients (r) of >0.70 ($p<0.01$). Data entry was conducted using Microsoft Excel 365 and statistical analyses were performed using version 26 of the Statistical Package for the Social Sciences (IBM Corp., Armonk, NY, USA). Categorical variables are reported as frequencies and percentages and the chi-square test was used for comparisons. A P value of <0.05 was considered statistically significant. This study adhered to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist for cross-sectional studies

RESULTS

Among 376 medical students included in this study, 251 (66.8%) were female and 125 (33.2%) were male. Their mean age was 21.36±1.945 years. The students who participated in the study were from various universities: Umm AlQura University (19.4%), King Abdulaziz University (22.1%), Jeddah University (8.0%), King Saud bin Abdulaziz University for Health Sciences (4.0%), Taif University (32.7%), Taibah University (11.4%) and other universities (2.4%). In terms of academic year, students in the third, fifth and fourth years made up the largest proportions, representing 21.8%, 19.7% and 19.1%, respectively. Followed by second-year (17.6%), then first-year (5.9%) and intern students (4.8%). Most students had a GPA of >4.75 (48.1%), while 39.6% had a GPA of 4.00 to 4.75. Moreover, about11.4% of students had a GPA of 3.00 to 3.99 and 0.8% had a GPA of 2.00 to 2.99 (Table 1).

The majority of students (75.5%) had no family history of HBV. More than half were immunised, either through hepatitis B vaccination (43.6%) or due to a previous infection (10.9%). A total of 12.8% were not immune, while 7.4% were chronically infected and 25.3% were unaware of their vaccination status. Among those fully immunised, 24.5% had received three doses of the vaccine and 5.6% had received booster shots. However, 10.1% had only received the first dose and 13.0% had received the second dose. Meanwhile, 11.7% had not received any doses and more than one-third (35.1%) were unsure of their immunisation status. The most common reasons for not being vaccinated were busy schedules (25.5%) and forgetting about the vaccine (22.9%). In addition, 16.0% were concerned about vaccine side effects or perceived the vaccine as ineffective, while 13.8% cited other reasons. Notably, 28.8% of students reported not knowing or not having access to vaccination sites (Table 2).

Table 1: Demographic Characteristics of the Study Sample (n = 376)

Variables	Frequency (n, %)
Gender	
Females	251 (66.8%)
Males	125 (33.2%)
Age	
Mean (SD)	21.36 (1.945)
University	
Umm Al-Qura University (UQU)	73 (19.4%)
King Abdulaziz University (KAU)	83 (22.1%)
Jeddah University (JU)	30 (8.0%)
King Saud bin Abdulaziz University for Health Sciences (KSAU-HS)	15 (4.0%)
Taif University	123 (32.7%)
Taibah University	43 (11.4%)
Other	9 (2.4%)
Academic Year	
1st Year	22 (5.9%)
2nd Year	66 (17.6%)
3rd Year	82 (21.8%)
4th Year	72 (19.1%)
5th Year	74 (19.7%)
6th Year	42 (11.2%)
Intern	18 (4.8%)
GPA	
2.00-2.99	3 (0.8%)
3.00-3.99	43 (11.4%)
4.00-4.75	149 (39.6%)
>4.75	181 (48.1%)

Table 2: HBV Status and Vaccination Compliance

Variables	Frequency (n, %)
Family history of infection of HBV	
Yes	92 (24.5%)
No	284 (75.5%)
HBV Status	
Immune due to previous infection	41 (10.9%)
Immune due to hepatitis B vaccination	164 (43.6%)
Susceptible (not immune)	48 (12.8%)
Chronically infected	28 (7.4%)
Don't know	95 (25.3%)
Number of HBV vaccine doses	
1 Dose	38 (10.1%)
2 Doses	49 (13.0%)
3 Doses (all doses)	92 (24.5%)
More than 3 doses	21 (5.6%)
None	44 (11.7%)
I don't know	132 (35.1%)
Reasons for not taking full doses *	
HBV vaccine is ineffective	52 (13.8%)
Difficulty in accessing the vaccination site	45 (14.4%)
Don't know where to be vaccinated	45 (14.4%)
Worried about side effects	60 (16.0%)
Busy Schedule	96 (25.5%)
Forgetting about the vaccine	86 (22.9%)
Other	14 (3.7%)

Each subject was able to choose more than one answer

Vaccination compliance among students was significantly associated with their university ($p<0.001$). Of the 376 students, 113 were fully vaccinated. Students from King Saud bin Abdulaziz University for Health Sciences showed the highest vaccination compliance (60.0%), followed by Umm Al-Qura University (50.7%) and King Abdulaziz University (31.3%). In contrast, compliance was lower among students from Taif University (22.8%), other universities (22.2%) and Jeddah University (20.0%). The lowest compliance was observed among students from Taibah University (11.6%) (Table 3).

In terms of knowledge about HBV, 39.6% of students correctly identified the HBV incubation period and 81.6% knew the site of viral replication. Additionally, 45.2% were aware of the persistence duration of hepatitis B surface antigen in chronically infected patients. Approximately three-quarters (75.5%) recognised that medical students are at a higher risk of contracting or spreading HBV. In addition, 61.4% knew that HBV is more contagious than HIV, 50.3% understood that HBV is infectious outside the body and 44.1% knew that HBV is resistant to alcohol. More than three-quarters (76.9%) were aware that infected mothers transmit the virus perinatally to 70% to 90% of their offspring, while 67.6% understood that action can be taken for infants born to infected mothers. However, only 42.6% knew that chronic infection would develop in nearly all children infected perinatally.

Table 3: Vaccination Compliance among Different Universities

University	Non-compliant (n, %)	Compliant (n, %)	p-value
UQU	36 (49.3)	37 (50.7)	<0.001*
KAU	57 (68.7)	26 (31.3)	
Jeddah University	24 (80.0)	6 (20.0)	
KSAU-HS	6 (40.0)	9 (60.0)	
Taif University	95 (77.2)	28 (22.8)	
Taibah University	38 (88.4)	5 (11.6)	
Other	7 (77.8)	2 (22.2)	
Total	263 (69.9)	113 (30.1)	

*Chi-square was used

Additionally, 63.0% of students believed that highrisk populations should be screened and 79.8% understood that healthcare professionals should be vaccinated against HBV. Furthermore, about 65.2% recognised the serious complications associated with HBV (Table 4 and 5).

DISCUSSION

HBV infection remains one of the most serious infectious health concerns in Saudi Arabia [2,6]. It can cause both acute and chronic liver disease, potentially progressing to cirrhosis, hepatocellular carcinoma, or liver failure [2]. Healthcare workers and medical students are at an increased risk due to occupational exposure to patients' bodily fluids [10]. In addition, the lack of experience among medical students may further heighten their risk of contracting the infection [13]. Therefore, this study was conducted among medical students in the Western Region of Saudi Arabia to assess their awareness and adherence to the HBV vaccine.

The findings revealed that most students (69.9%) across all universities were not compliant with the HBV vaccine, which is consistent with a similar study conducted in Riyadh, Saudi Arabia [1]. Among the universities, King Saud bin Abdulaziz University for Health Sciences demonstrated the highest vaccination compliance (60.0%), followed bay Umm Al-Qura University (50.7%).

Table 4: The Knowledge Regarding HBV among Medical Students

Question	Response	n	(%)
1- How long is the incubation period for HBV?	Less than 28 days	96	24.2
	1-6 months	162	40.9
	6-12 months	84	21.2
	More than 1 year	54	13.6
2- Where is the site of replication of HBV?	In the heart	25	6.3
	In the liver	326	82.3
	In the lung	24	6.1
	In the kidney	21	5.3
3- How long does the chronic infection persist?	2-5 weeks	53	13.4
	3 months	92	23.2
	4-6 months	69	17.2
	>6 months	183	46.2
4- Medical students are at higher risk of contracting/spreading HBV?	True	302	76.3
	False	94	23.7
5- HBV is almost 100 times more transmissible than HIV	True	246	62.1
	False	150	37.9
6- HBV is not infectious outside the body	True	196	49.5
	False	200	50.5
7- HBV is resistant to alcohol and some detergents	True	173	43.7
	False	223	56.3
8- Infected mothers pass the virus perinatally to 70-90% of their offspring	True	308	77.8
	False	88	22.2
	True	126	31.8
9- No action can be taken for an infant whose mother is infected with HBV	False	270	68.2
10- A chronic infection will develop in almost all children infected perinatally	True	227	57.3
	False	169	42.7
11- High-risk populations should not be screened for HBV infection	True	142	35.9
	False	254	64.1
12- Healthcare professionals should receive the HBV vaccine	True	318	80.3
	False	78	19.7
13-There are no serious complications of HBV	True	132	33.3
	False	264	66.7

NB: The correct answer is highlighted

Table 5: General Knowledge of Students Regarding HBV

		University							
	Correct answers	UQU n = 73	KAU n = 83	JU n = 30	KSAUHS n = 15	Taif University n = 123	Taibah University n = 43	Other n= 9	p value
Hepatitis B knowledge questions	N, (%)	N, (%)	N, (%)	N, (%)	N, (%)	N, (%)	N, (%)	N, (%)	
The incubation period of HBV	149 (39.6)	43 (58.9)	28 (33.7)	14(46.7)	4 (26.7)	41 (33.3)	13 (30.2)	6 (66.7)	0.009*
Site of replication of HBV	307 (81.6)	66 (90.4)	68 (81.9)	27 (90.0)	10 (66.7)	93 (75.6)	35 (81.4)	8 (88.9)	0.261
Chronic infection persistence duration	170 (45.2)	41 (56.2)	40 (48.2)	10 (33.3)	5 (33.3)	54 (43.9)	16 (37.2)	4 (44.4)	0.733
Medical students are at higher risk of contracting/spreading HBV	284 (75.5)	63 (86.3)	60 (72.3)	25 (83.3)	11 (73.3)	87 (70.7)	30 (69.8)	8 (88.9)	0.16
HBV is almost 100 times more transmissible than HIV	231 (61.4)	55 (75.3)	47 (56.6)	18 (60.0)	8 (53.3)	73 (59.3)	24 (55.8)	6 (66.7)	0.23
HBV is not infectious outside the body	189 (50.3)	43 (58.9)	46 (55.4)	13 (43.3)	7 (46.7)	55 (44.7)	22 (51.2)	3 (33.3)	0.393
HBV is resistant to alcohol and some detergents	166 (44.1)	27 (37.0)	26 (31.3)	14 (46.7)	6 (40.0)	58 (47.2)	28 (65.1)	7 (77.8)	0.003*
Infected mothers pass the virus perinatally to 70-90% of their offspring	289 (76.9)	58 (79.5)	64 (77.1)	23 (76.7)	8 (53.3)	96 (78.0)	31 (72.1)	9 (100)	0.217
No action can be taken for an infant whose mother is infected with HBV	254 (67.6)	59 (80.8)	56 (67.5)	20 (66.7)	10 (66.7)	73 (59.7)	28 (65.1)	8 (88.9)	0.070
A chronic infection will develop in almost all children infected perinatally	160 (42.6)	34 (46.6)	34 (41.0)	10 (33.3)	8 (53.3)	50 (40.7)	19 (44.2)	5 (55.6)	0.786
High-risk populations should not be screened for HBV infection	237 (63.0)	51 (69.9)	58 (69.9)	13 (43.3)	7 (46.7)	77 (62.6)	24 (55.8)	7 (77.8)	0.070
Healthcare professionals should receive the HBV vaccine	300 (79.8)	64 (87.7)	69 (83.1)	20 (66.7)	11(73.3)	93 (75.6)	34 (79.1)	9 (100)	0.101
There are no serious complications of HBV	245 (65.2)	55 (75.3)	54 (65.1)	18(60.0)	8 (53.3)	77 (62.6)	25 (58.1)	8 (88.9)	0.229

Means significant, the test used is Pearson Chi-square test

This higher compliance may be attributed to a better understanding of the infection, its consequences, or effective immunisation checks. Conversely, the lowest vaccination compliance (11.6%) was observed at Taibah University, possibly due to the absence of a follow-up system and a lack of awareness regarding the guidelines. Also, important to note that HBV vaccination policy different from each university which may influence student adherence states.

In this study, 24.5% of the students reported a family history of HBV infection, highlighting the need for targeted awareness and vaccination campaigns, particularly among families affected by HBV. Most students (43.6%) were immune due to HBV vaccination, while 10.9% were immune as a result of previous infection. Additionally, 12.8% were susceptible and 7.4% were chronically infected, underscoring the importance of proper training and comprehensive HBV vaccination coverage [14]. Furthermore, 25.3% of students were unaware of their immunisation status, suggesting a need for increased awareness of HBV status and vaccination. This finding aligns with a study conducted in the Sultanate of Oman, where 45.5% of participants were uncertain about their vaccination status [15].

Another significant finding was that 35.1% of students did not know how many doses of the vaccine they had received, indicating a lack of recall and possibly insufficient vaccination records. This is consistent with studies from Riyadh and Aljouf, where 12 and 37% of participants, respectively, were unsure about their vaccination doses or had lost follow-up [3,16]. Moreover, 23.1% of students reported not having completed the full course of the vaccine. Similar rates of incomplete vaccination were found in studies conducted in Riyadh, Ethiopia and India, where 28.3, 25.7 and 15.2% of participants, respectively, did not complete all doses of the HBV vaccine [3,17,18]. Additionally, 11.7% of students in our study reported never having received the vaccine, a finding that aligns with results from studies in Oman (14.4%), Aljouf (10.9%) and Turkey (8.1%) [16,19]. In contrast, some studies reported much higher rates of non-vaccination; for instance, in Ethiopia, 74.3% of participants had never received the hepatitis B vaccine [18], while a study from India found that 59.6% of medical students had not been vaccinated [17].

Our study also showed that 30.1% of students had received three or more doses of the vaccine, classifying them as fully immunised. Similar findings were obtained from a study conducted at a tertiary institution in southeast Nigeria, where 29.4% of medical students were fully immunised against HBV [20]. In contrast, higher percentages of full immunisation were reported in studies from Turkey (91.2%) and Riyadh (59.5%) [1,19]. These differences may be due to increased awareness and knowledge of HBV infection and its consequences [19] or the presence of follow-up systems ensuring full immunisation [1]. Lower percentages of full immunisation were found in studies from Cameroon and Somalia, with rates of 16.8 and 2.8%, respectively [2,21]. A study in Ethiopia reported that only 5.8% of medical and health science students had received all three doses of the HBV vaccine [18]. Such variations are likely due to differences in socioeconomic status [2,18], vaccine

availability [2,18,21] and the absence of HBV vaccination policies for high-risk groups in countries such as Somalia and Cameroon [21,22].

The most common reason for non-compliance in our study was a busy schedule (25.5%), followed by forgetting about the vaccine (22.9%), suggesting that personal factors play a significant role in incomplete vaccination. This is in line with studies conducted in Riyadh [1,3] and Ethiopia [18]. In contrast, studies from Somalia, Ethiopia and Nigeria identified the unavailability and high cost of the HBV vaccine as the primary reasons for non-compliance [2,18,20]. In Turkey, the most common reason for non-compliance was a lack of knowledge about where the vaccine could be administered [19].

The knowledge of HBV and vaccine adherence among medical students is crucial given their heightened risk of infection. Our study showed that participants had a moderate level of knowledge regarding HBV infection. Approximately 39.6% of students were aware of the HBV incubation period and 44.1% knew that HBV is resistant to alcohol. These findings are consistent with a study conducted in Riyadh, where less than 50% of participants were unaware of the HBV incubation period [1] and with results from Aljouf University, where many participants did not know that HBV is resistant to alcohol [16]. In our study, 50.3% of students were aware that HBV is infectious outside the body, a finding similar to a study from India, where 42.8% of students knew this [22].

Despite the moderate knowledge level, most medical students (75.5%) recognized that they are at a higher risk of contracting HBV and 79.8% understood that healthcare professionals should receive the HBV vaccine. These findings align with studies from Qassim and Kenya, further underscoring the global relevance of this issue. The impact of these findings on future healthcare practices is significant because they highlight the need for improved awareness and vaccination adherence among medical students who are at high risk of contracting HBV [12,23].

Strength of the Study

This study has several strengths, including being the first to assess HBV awareness and vaccination adherence among medical students in the Western Region of Saudi Arabia. The study sample was diverse, enhancing the generalizability of the findings and the questionnaire used was both valid and comprehensive.

CONCLUSION

In conclusion, medical students are considered as an elevated risk group for HBV infection. In the Western Region of Saudi Arabia, more than half of medical students have been immunised, either through vaccination or previous infection. However, over one-third of students were unaware of their immunisation status and poor vaccine compliance persists despite moderate HBV knowledge. Therefore, educational programmes targeting medical students are essential to improve vaccine compliance and reduce the incidence of HBV infections and related complications.

Limitation of the Study:

- However, the study's reliance on self-reported data introduces the possibility of recall and response bias. Convenience sampling and it is cross sectional study, no compares of different university police
- Future research should consider testing participants' HBV antibody titres. Also, expand the sample size to include other regions of Saudi Arabia for greater representativeness

Informed Consent

Informed consent was obtained from all participants at the start of the questionnaire.

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Conflicts of Interest

The authors declare that there is no conflict of interest.

Ethical Statement

The study was conducted after receiving ethical approval from the Research Ethics Committee of Umm Al-Qura University in October 2023 (Approval No. HAPO-02-K012-2023-10-1828). Informed consent was obtained from the students prior to data collection.

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